A Guardian Angel for Peach Trees

ROB FLYNN (K8223-16)

Shaving away bark with a pocket knife, horticulturist Tom Beckman examines a tree killed by PTSL disease. The healthy tree to the left is growing on the new Guardian rootstock.

Horticulturist Thomas G. Beckman has found a "guardian angel" for disease-threatened peach trees. Beckman and Clemson University scientists co-developed a new rootstock, called Guardian, that protects trees from peach tree short life (PTSL) disease.

The leading cause of tree death in the southeast region, PTSL costs peach growers about $10 million in damages annually. It is seen as a sudden collapse and death of peach trees in the spring, usually when the tree is between 3 and 7 years old.

U.S. growers produce about 2.6 billion pounds of peaches annually. Now, naturally sweet peaches, packed with flavor, have Beckman's new rootstock to protect them, ensuring their arrival to grocery produce sections and local fruit stands.

"To date, the performance of Guardian rootstock on PTSL sites in the southeastern United States has been exceptional," says Beckman, a scientist with the Agricultural Research Service's Southeastern Fruit and Tree Nut Research Laboratory in Byron, Georgia.

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Though the top is dead from peach tree short life disease, suckers sprouting at ground level show the roots remain alive.

The first commercial-scale trial of Guardian began in 1989. Scientists planted trees in South Carolina and Georgia to compare those grown on Lovell and Nemaguard—two commonly used commercial rootstocks—with trees grown on Guardian. Lovell has tolerance to PTSL, and Nemaguard has resistance to root knot nematodes. Guardian has a unique combination of both.

In the trial, completed in 1996, no Guardian rootstock trees were lost to PTSL in South Carolina and only 20 percent were lost in Georgia. Beckman says the trees in South Carolina were grown under best management practices, while the trees in Georgia were planted under a worst-case scenario—no lime, fall rather than spring pruning, and no nematicides.

In comparison plantings, PTSL claimed 97 percent of Lovell rootstock trees in South Carolina and 40 percent in Georgia. For Nemaguard, 95 percent in South Carolina and 80 percent in Georgia succumbed to the disease.

"While we're not sure what causes short life, we do know some things that can help," Beckman says.

Keeping soil pH above 6 to reduce acidity, pruning just before bloom in February or March, and fumigating to control ring nematodes are some of the most important things growers can do.

"We believe ring nematodes predispose the tree to injury by winter cold and bacterial canker," says Beckman. "Unfortunately, it is not always cost effective for growers to fumigate routinely."

ARS and Clemson have jointly applied for a plant variety protection certificate on Guardian rootstock. They released Guardian to nurseries in 1993.

Demand for Guardian seed initially outstripped supply, because a severe frost in 1996 destroyed the Byron crop and reduced the Clemson crop. The rootstock is available only through licensed nurseries, and demand has been from 1 to 2 million seeds per year for the Southeast alone. Beckman says as of 1997, supplies have been adequate to meet commercial needs. He is confident that establishment of a seed bank as a hedge against future failures will ensure adequate supplies.

Beckman is gauging Guardian's adaptability in other regions. He and cooperators are testing it at 20 sites in North America, including Canada. It will be a few years before he can measure results, but the rootstock's future as a guardian angel is bright.

"Guardian has excellent potential to replace both popular commercial rootstocks in the Southeast," says Beckman.—By **Tara Weaver,** ARS.

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Horticulturist Tom Beckman checks greenhouse-grown Guardian hybrids.

Enzymes Give Plants UV Protection

Sunlight would kill plants, without enzyme "scissors" that undo gene damage from ultraviolet (UV) rays. In fact, plants have several natural gene menders tailored to the kind of damage done, according to findings of an Agricultural Research Service scientist working with a researcher at the University of California at Davis.

Ultraviolet damage to crops is rare. But knowing the repair mechanisms may be important if UV radiation increases in the future as a result of thinning of Earth's protective ozone layer.

The scientists used *Arabidopsis,* a common white-flowered plant with a small number of genes, which allows for easy tracking of genetic differences.

DNA is a series of chemical bases—A-G-C-T (for adenine, guanine, cystosine, and thiamine)—that form the alphabet of life. If they get damaged, the code is illegible; too much unreadable code and the plant dies.

Plants may respond in several ways to gene damage.

"When your car breaks down, says ARS plant physiologist Edwin L. Fiscus, "you can call someone who does general repairs. But other times, a specialist may be able to perform a particular type of repair much more rapidly and efficiently.

"It's like that for plant cell damage," says Fiscus, who works in the ARS Air Quality-Plant Growth and Development Research Unit. "To fix damaged DNA, there are both general repair enzymes and at least two highly specialized kinds."

Fiscus and geneticist Anne Britt at UC-Davis confirmed what others suspected: that two specialized enzymes in plants are essential for UV repair. They are both from a class of enzymes called photolyases.

The generalized repair enzyme system, says Britt, is probably designed for a wide variety of relatively rare types of damage. It works by excising the damaged bases, or sequences, and rebuilding them—a process that tends to be slow and inefficient.

More common kinds of damage, such as when UV light causes Ts and Cs to crosslink improperly to each other, are also repaired by specialized photolyases, which eliminate this inappropriate bond between the bases. Photolyase repair is specific, rapid, efficient, and—like excision repair—relatively error-free.

Another interesting thing about these enzymes, Britt says, is that they are activated by light, so the very cause of the UV damage is also what triggers its repair.

The scientists proved photolyase enzymes are essential for plants' survival in natural light by using special mutant plants developed by Britt that can't produce the enzymes.

Fiscus, whose research station is on the campus of North Carolina State University, devised special growth chambers that delivered precise doses of various ratios of UV light and regular sunlight. The mutant plants were highly sensitive to UV light, compared to normal plants.—By **Jill Lee,** ARS.

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